Action for a cleaner tomorrow
Science
Kindergarten

This correlation of South Carolina Curriculum Standards only applies to those lessons related to energy topics and issues. There are more than 150 lessons in *Action for a cleaner tomorrow* correlated to English/Language Arts, Math, Science and Social Studies standards.

I. Inquiry

Process skills and inquiries are not an isolated unit of instruction and should be embedded throughout the content areas. Safety issues should be addressed as developmentally appropriate.

A. Process Skills

1. Observe

a. Use the senses and simple tools to gather information about objects or events such as size, shape, color, texture, sound, position and change (qualitative observations).
What's Energy?

4. Communicate

a. Use drawings, tables, graphs, written and oral language to describe objects and explain ideas and actions.
What's Energy?

B. Inquiry

1. Plan and conduct a simple investigation.

a. Ask a question about objects, organisms and events in the environment that could start an investigation.
What's Energy?

b. Use simple equipment to gather data and extend the senses.
What's Energy?

II. Life Science

Units of Study: Animals and Plants
My Body

A. Characteristics of Organisms

1. Organisms have basic needs.

b. Investigate and identify the natural resources (food, water and air) that living things need to survive. **(P)**
What's Energy?

2. Humans have distinct body structures for walking, holding, seeing and talking.

a. Name major body parts.
What's Energy?

b. Identify the uses of body parts.
What's Energy?

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3. Humans have senses including sight, smell, hearing, touch and taste.

a. Describe the five senses.
What's Energy?

b. Investigate using sensory organs associated with each of the senses.
What's Energy?

c. Communicate using sensory descriptors (e.g., sweet, sour, bitter, salty, rough, smooth, hard, soft, cold, warm, hot, loud, high, low, bright and dull).
What's Energy?

III. Earth Science

Units of Study: Rocks, Soil and Water
Seasonal Changes

A. Properties of Earth Materials

1. Solid rocks, soils and water are earth materials.

c. Describe a way to conserve water at home or at school. **(P)**
What's Energy?

B. Changes in Earth and Sky

1. Weather changes from day to day and over the seasons.

c. Describe how seasonal changes may affect plants and animals.
What's Energy?

IV. Physical Science

Unit of Study: Exploring Matter

A. Properties of Objects and Materials

1. Objects have many observable properties.

d. Observe that objects can move.
What's Energy?

Grade One

I. Inquiry

Process skills and inquiries are not an isolated unit of instruction and should be embedded throughout the content areas. Safety issues should be addressed as developmentally appropriate.

A. Process Skills

1. Observe

a. Use the senses and simple tools to gather information about objects or events such as size, shape, color, texture, sound, position and change (qualitative observations).
What's Energy?

4. Communicate

a. Use drawings, tables, graphs, written and oral language to describe objects and explain ideas and actions.
What's Energy?

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B. Inquiry

1. Plan and conduct a simple investigation.

a. Ask a question about objects, organisms and events in the environment.
What's Energy?

b. Employ simple equipment such as hand lenses, thermometers, balances, etc., to gather data and extend the senses.
What's Energy?

III. Earth Science

Unit of Study: Things in the Sky

A. Objects in the Sky

1. The sun, moon and stars have properties, locations and movements that can be observed and described.

b. Identify that the sun is a star and is the source of heat and light for Earth.
What's Energy?

IV. Physical Science

Units of Study: Properties of Objects and Materials
Exploring Motion

B. Position and Motion of Objects

1. The position and motion of objects can be changed by pushing and pulling.

a. Investigate the effect of a push or a pull on the position and motion of common objects.
What's Energy?

b. Explore and describe patterns of motion.
What's Energy?

Grade Two

III. Earth Science

Unit of Study: Weather

B. Changes in the Earth and Sky

1. Weather can be described by measurable quantities such as temperature, wind direction and precipitation.

a. Measure and record temperature in both degrees Fahrenheit and Celsius.
What's Energy?

c. Investigate and describe changes in wind direction and the motion of objects due to wind.
What's Energy?

Grade Three

IV. Physical Science

Units of Study: Heat and Changes and Matter
Machines and Motion

A. Property of Objects and Materials

1. Some common materials, such as water, can be changed from one state to

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another by heating or cooling.

b. Measure, record and graph the temperature (Celsius and Fahrenheit) of matter as it is heated and cooled.
What's Energy?

2. **Heat can be produced in many ways, such as burning and rubbing or mixing one substance with another. Heat can move from one object to another by conduction**.

a. Explore and identify things that produce heat.
What's Energy?

d. Investigate and describe what materials can be used to prevent heat from moving from one object to another, such as insulators, and apply to real world examples.
What's Energy?

B. Position and Motion of Objects

1. **The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull**.

a. Investigate and describe push and pull involved in simple machines.
What's Energy?

e. Observe the motion of simple machines in toys and in playground activities.
What's Energy?

Grade Four

I. Inquiry

Process skills and inquiries are not an isolated unit of instruction and should be embedded throughout the content areas. Safety issues should be addressed as developmentally appropriate.

A. Process Skills

1. **Observe**

a. Use the senses and simple tools to gather information about objects or events such as size, shape, color, texture, sound, position and change (qualitative observations).
Conserving Energy

2. **Classify**

b. Arrange objects in sequential order.
Energy to Produce Food

3. **Measure**

a. Use standard (U.S. customary and metric) to estimate and measure mass, length, area, perimeter, volume and temperature to the nearest whole unit (quantitative observations).
Conserving Energy

4. **Communicate**

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a. Use drawings, tables, graphs, written and oral language to describe objects and explain ideas and actions.
Energy to Produce Food
Conserving Energy
Living Without Power
Power in South Carolina

5. Infer

a. Explain or interpret an observation based on data and prior knowledge.
Conserving Energy

b. Discriminate between observations and inferences.
Conserving Energy

6. Predict

a. Use prior knowledge and observations to identify and explain in advance what will happen.
Conserving Energy

b. Discriminate between inferences and predictions.
Conserving Energy

B. Inquiry

1. Plan and conduct a simple investigation.

a. Ask a question about objects, organisms and events in the environment.
Conserving Energy

b. Plan and conduct a simple investigation - a fair test.
Conserving Energy

c. Select and use appropriate equipment and tools to gather data and extend the senses.
Conserving Energy

d. Use data to construct a reasonable explanation.
Conserving Energy

e. Communicate investigations and explanations.
Conserving Energy

II. Life Science

Unit of Study: Organisms and Their Environment

B. Organisms and Their Environments

3. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.

a. Describe changes in the environment caused by humans. **(H)**
Energy to Produce Food
Power in South Carolina

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b. Infer the impact of agricultural technology (e.g., air/land/ water pollution and improved crop yield) on society and the environment. **(T)**
Energy to Produce Food

c. Infer the impact of industrial technologies (e.g., air/land/water pollution and improved standard of living) on society and the environment. **(T)**
Energy to Produce Food
Conserving Energy
Power in South Carolina

III. Earth Science

Units of Study: Sky Patterns
Weather and Climate

B. Changes in the Earth and Sky

1. Weather changes from day to day and over the seasons.

e. Research and describe severe weather phenomena, technological advances and related safety concerns. **(T, P)**
Living Without Power

IV. Physical Science

Units of Study: Electricity and Magnetism
Light and Sound

B. Electricity and Magnetism

1. Electricity in circuits can produce light, heat, sound and magnetic effect.

a. Recognize that electricity is a form of energy and can produce light and heat.
Energy to Produce Food
Conserving Energy
Living Without Power
Power in South Carolina

d. Predict and test various materials to identify conductors and insulators.
Conserving Energy

g. Describe how humans use electricity. **(P)**
Energy to Produce Food
Conserving Energy
Living Without Power
Power in South Carolina

2. Magnets attract and repel each other and certain kinds of other materials.

g. Apply electromagnetism to real world situations. **(T, P)**
Power in South Carolina

Grade Five

I. Inquiry

Process skills and inquiries are not an isolated unit of instruction and should be embedded throughout the content areas. Safety issues should be addressed as developmentally appropriate.

A. Process Skills

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1. **Observe**
   a. Use the senses and simple tools to gather information about objects or events such as size, shape, color, texture, sound, position and change (qualitative observations).
      Conserving Energy

2. **Classify**
   b. Arrange objects in sequential order.
      Energy to Produce Food

3. **Measure**
   a. Use standard (U.S. customary and metric) to estimate and measure mass, length, area, perimeter, volume and temperature to the nearest whole unit (quantitative observations).
      Conserving Energy

4. **Communicate**
   a. Use drawings, tables, graphs, written and oral language to describe objects and explain ideas and actions.
      Energy to Produce Food
      Conserving Energy
      Living Without Power
      Power in South Carolina

5. **Infer**
   a. Explain or interpret an observation based on data and prior knowledge.
      Conserving Energy

   b. Discriminate between observations and inferences.
      Conserving Energy

6. **Predict**
   a. Use prior knowledge and observations to identify and explain in advance what will happen.
      Conserving Energy

   b. Discriminate between inferences and predictions.
      Conserving Energy

7. **Hypothesize**
   a. Devise a statement of assumption based on observations, experiences and research that can be supported or refuted through experimentation.
      Conserving Energy

8. **Define variables**
   a. Identify independent (manipulated), dependent (responding) and controlled variables in an experiment.
      Conserving Energy

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B. Inquiry

1. Plan and conduct a simple investigation.

a. Identify questions that can be answered through scientific investigations.
Conserving Energy

b. Design and conduct a scientific investigation.
Conserving Energy

c. Use appropriate tools and techniques to gather, analyze and interpret data.
Conserving Energy

d. Develop descriptions, explanations, predictions and models using evidence.
Conserving Energy

e. Use mathematical thinking in all aspects of scientific inquiry.
Conserving Energy

f. Communicate outcomes and explanations.
Conserving Energy

C. Abilities of Technological Design

1. Identify appropriate problems for technological design.

a. Identify a specific need for a product.
Conserving Energy

b. Determine whether the product will meet the needs and be used.
Conserving Energy

2. Design a solution or product.

a. Compare and contrast different proposals using selected criteria (e.g., cost, time, trade-off and materials needed).
Conserving Energy

b. Communicate ideas with drawings and simple models.
Conserving Energy

II. Life Science

Units of Study: Cells and Systems
Ecosystems (Aquatic/Terrestrial)

B. Populations and Ecosystems

3. For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is used by producers through photosynthesis.

a. Recognize that energy passes from organism to organism in food webs.
Energy to Produce Food

4. The number of organisms an ecosystem can support depends on the resources available.

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a. Identify and investigate the abiotic factors in an ecosystem such as quantity of light, air and water, range of temperature, salinity, water pressure and soil composition.
Energy to Produce Food

d. Evaluate the impact of the environment on populations of organisms.
Living Without Power

e. Draw conclusions about the influence of human activity on ecosystems. **(P)**
Energy to Produce Food
Power in South Carolina

f. Discuss ways to minimize the negative impact of technology/industralization on the ecosystem and maximize the positive aspect. **(T)**
Power in South Carolina

IV. Physical Science

Units of Study: Mixtures and Solutions
Forces, Motion and Design

B. Motions and Forces

2. If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another.

b. Investigate and describe how forces affect the motion of objects.
Power in South Carolina

c. Analyze a device with parts that move and determine the purpose of each moving part and the overall purpose of the device.
Power in South Carolina

Grade Six

I. Inquiry

A. Abilities Necessary to do Scientific Inquiry

1. Identify process skills that can be used in scientific investigations.

a. Observe

2. Distinguish between qualitative and quantitative observations.
Energy from the Sun

b. Measure

1. Select and use appropriate tools (e.g., metric ruler, graduated cylinder, thermometer, balances, spring scales and stopwatches) and units (e.g., meter, liter, Celsius, gram, Newton and second) to measure to the unit required in a particular situation.
Energy from the Sun

2. Select and use appropriate metric prefixes to include milli-, centi- and kilo.
Energy from the Sun

c. Infer

1. Make inferences based on observations.

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Energy from the Sun

2. Design and conduct a scientific investigation.

b. Pose questions and problems to be investigated.
Energy from the Sun

c. Obtain scientific information from a variety of sources (such as Internet, electronic encyclopedias, journals, community resources, etc.).
Power in South Carolina
Energy from the Sun

f. Collect and record data using appropriate metric measurements.
Energy from the Sun

g. Organize data in tables and graphs.
Recycling: It's an Energy Issue

h. Analyze data to construct explanations and draw conclusions.
Energy from the Sun

3. Use appropriate tools and techniques to gather, analyze and interpret data.

a. Select and use appropriate tools and technology (such as calculators, computers, probes, thermometers, balances, spring scales, microscopes, binoculars and hand lenses) to perform tests, collect and display data.
Energy from the Sun

4. Develop descriptions, explanations, predictions and models using evidence.

a. Discriminate among observations, inferences and predictions.
Energy from the Sun

b. Construct and/or use models to carry out/support scientific investigations.
Energy from the Sun

5. Think critically and logically to make relationships between evidence and explanations.

a. Review and summarize data to show cause-effect relationships in experiments.
Energy from the Sun

6. Recognize and analyze alternative explanations and predictions.

a. Analyze different ideas and explanations to consider alternative ideas.
Energy from the Sun

b. Accept the skepticism of others as part of the scientific process. **(N)**
Energy from the Sun

7. Communicate scientific procedures and explanations.

a. Use drawings, written and oral expression to communicate information.

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Power in South Carolina
Energy from the Sun

b. Create drawings, diagrams, charts, tables and graphs to communicate data.
Power in South Carolina

d. Create and/or use scientific models to communicate information.
Energy from the Sun

8. Use mathematics in all aspects of scientific inquiry.

a. Use mathematics to gather, organize and present data.
Energy from the Sun

b. Use mathematics to structure convincing explanations.
Energy from the Sun

B. Abilities Necessary to Do Technological Design

1. Identify appropriate problems for technological design.

a. Identify a specific need for a product.
Power in South Carolina
Energy from the Sun

b. Determine whether the product will meet the needs and be used.
Power in South Carolina
Energy from the Sun

2. Design a solution or product.

a. Compare and contrast different proposals using selected criteria (e.g., cost, time, trade-off and materials needed).
Power in South Carolina
Energy from the Sun

b. Communicate ideas with drawings and simple models.
Energy from the Sun

3. Implement a proposed design.

a. Select suitable tools and techniques to ensure adequate accuracy.
Energy from the Sun

b. Organize materials, devise a plan and work collaboratively where appropriate.
Energy from the Sun

4. Evaluate completed technological designs or products.

a. Measure the quality of the product based on the original purpose or need and the degree to which it meets the needs of the users.
Energy from the Sun

b. Suggest improvements and try proposed modifications to the design.

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Energy from the Sun

5. **Communicate the process of technological design.**
   a. Identify the stages of problem design: (1) problem identification, (2) solution design, (3) implementation and (4) evaluation.
      Power in South Carolina
      Energy from the Sun

C. Understandings about Science and Technology

1. **Scientific inquiry and technological design have similarities and differences.**
   a. Compare and contrast scientific inquiry and technological design.
      Power in South Carolina
      Energy from the Sun

2. **Many different people in different cultures have made and continue to make contributions to science and technology.**
   a. Describe examples of contributions people have made to science and technology. **(H, N)**
      Recycling: It's an Energy Issue
      Power in South Carolina
      Energy from the Sun

3. **Science and technology are reciprocal.**
   a. Explain how science and technology are essential to each other. **(T)**
      Power in South Carolina
      Energy from the Sun

4. **Perfectly designed solutions do not exist.**
   a. Discuss factors that affect product design and alter the original design. **(T)**
      Energy from the Sun

   b. Discuss risks versus benefit factors in product design. **(P)**
      Recycling: It's an Energy Issue
      Energy from the Sun

5. **Technological designs have constraints.**
   a. Describe examples of constraints on technological designs. **(T)**
      Recycling: It's an Energy Issue
      Power in South Carolina
      Energy from the Sun

   b. Explain why constraints on technological design are unavoidable. **(T, N)**
      Recycling: It's an Energy Issue
      Power in South Carolina
      Energy from the Sun

6. **Technological solutions have intended benefits and unintended consequences.**

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Power in South Carolina
Energy from the Sun

IV. Physical Science

Unit of Study: Forms and Transfer of Energy

C. Energy is transferred in many ways.

1. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound and the nature of a chemical.

a. Identify sources of heat, light, sound, electrical and chemical energy and mechanical motion.
Power in South Carolina
Energy from the Sun

b. Recognize and identify heat, light, sound, electrical and chemical energy and mechanical motion as forms of energy.
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

2. Energy is transferred in many ways.

a. Demonstrate how mechanical energy is transformed to another form of energy (e.g., vibrations, heat through friction).
Power in South Carolina

b. Demonstrate how chemical energy is transformed to another form of energy (e.g., light wands, lightning bugs, batteries and bulbs).
Power in South Carolina

3. Heat moves in predictable ways, flowing from warmer to cooler objects, until both reach the same temperature.

a. Analyze and use examples to show how conduction, convection or radiation factors enhance the flow of heat.
Energy from the Sun

4. Electrical circuits provide a means of transferring electrical energy when heat, light, sound and chemical changes are produced. Heat, light, mechanical motion or electricity might be involved in such transfers.

b. Relate electricity to magnetism (e.g., electromagnets and simple electric motors) using descriptions and diagrams.
Power in South Carolina

d. Explain how generators produce electricity from mechanical motion.
Power in South Carolina

5. The sun is a major source of energy for changes on the Earth's surface.

a. Measure temperature differences as the sun or a model of the sun warms different surfaces.
Energy from the Sun

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c. Investigate and describe practical uses of solar energy (e.g., solar ovens, water heaters, calculators, etc.).
Energy from the Sun

Grade Seven

I. Inquiry

A. Abilities Necessary to do Scientific Inquiry

1. Identify process skills that can be used in scientific investigations.

a. Observe

2. Distinguish between qualitative and quantitative observations.
Energy from the Sun

c. Measure

1. Select and use appropriate tools (e.g., metric ruler, graduated cylinder, thermometer, balances, spring scales and stopwatches) and units (e.g., meter, liter, Celsius, gram, Newton and second) to measure to the unit required in a particular situation.
Energy from the Sun

2. Select and use appropriate metric prefixes to include milli-, centi- and kilo-.
Energy from the Sun

d. Infer

1. Make inferences based on observations.
Energy from the Sun

2. Design and conduct a scientific investigation.

b. Pose questions and problems to be investigated.
Energy from the Sun

c. Obtain scientific information from a variety of sources (such as Internet, electronic encyclopedias, journals, community resources, etc.).
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

f. Collect and record data using appropriate metric measurements.
Energy from the Sun

d. Organize data in tables and graphs.
Recycling: It's an Energy Issue

e. Analyze data to construct explanations and draw conclusions.
Energy from the Sun

3. Use appropriate tools and techniques to gather, analyze and interpret data.

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a. Select and use appropriate tools and technology (such as calculators, computers, probes, thermometers, balances, spring scales, microscopes, binoculars and hand lenses) to perform tests, collect data and display data.
Energy from the Sun

4. Develop descriptions, explanations, predictions and models using evidence.

a. Discriminate among observations, inferences and predictions.
Energy from the Sun

b. Construct and/or use models to carry out/support scientific investigations.
Energy from the Sun

5. Think critically and logically to make relationships between evidence and explanations.

a. Review and summarize data to show cause-effect relationships in experiments.
Energy from the Sun

6. Recognize and analyze alternative explanations and predictions.

a. Analyze different ideas and explanations to consider alternative ideas.
Energy from the Sun

b. Accept the skepticism of others as part of the scientific process.
Energy from the Sun

7. Communicate scientific procedures and explanations.

a. Use drawings, written and oral expression to communicate information.
Recycling: It's an Energy Issue
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Energy from the Sun

b. Create drawings, diagrams, charts, tables and graphs to communicate data.
Recycling: It's an Energy Issue
V. *Power in South Carolina*

c. Interpret and describe patterns of data on drawings, diagrams, charts, tables, graphs and maps.
Recycling: It's an Energy Issue

d. Create and/or use scientific models to communicate information.
Energy from the Sun

8. Use mathematics in all aspects of scientific inquiry.

a. Use mathematics to gather, organize and present data.
Recycling: It's an Energy Issue
Energy from the Sun

b. Use mathematics to structure convincing explanations.

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Recycling: It's an Energy Issue
Energy from the Sun

B. Abilities of Technological Design

1. Identify appropriate problems for technological design.

a. Identify a specific need for a product.
Power in South Carolina
Energy from the Sun

b. Determine whether the product will meet the needs and be used.
Power in South Carolina
Energy from the Sun

2. Design a solution or product.

a. Compare and contrast different proposals using selected criteria (e.g., cost, time, trade-off and materials needed).
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

b. Communicate ideas with drawings and simple models.
Energy from the Sun

3. Implement a proposed design.

a. Select suitable tools and techniques to ensure adequate accuracy.
Energy from the Sun

b. Organize materials, devise a plan and work collaboratively where appropriate.
Energy from the Sun

4. Evaluate completed technological designs or products.

a. Measure the quality of the product based on the original purpose or need and the degree to which it meets the needs of the users.
Energy from the Sun

b. Suggest improvements and try proposed modifications to the design.
Energy from the Sun

5. Communicate the process of technological design.

a. Identify the stages of problem design: (1) problem identification, (2) solution design, (3) implementation and (4) evaluation.
Recycling: It's an Energy Issue
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Energy from the Sun

C. Understandings about Science and Technology

1. Scientific inquiry and technological design have similarities and differences.

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a. Compare and contrast scientific inquiry and technological design.
Power in South Carolina
Energy from the Sun

2. Many different people in different cultures have made and continue to make contributions to science and technology.

a. Describe examples of contributions people have made to science and technology. **(H, N)**
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

3. Science and technology are reciprocal.

a. Explain how science and technology are essential to each other. **(T)**
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

4. Perfectly designed solutions do not exist.

a. Discuss factors that affect product design and alter the original design. **(T)**
Energy from the Sun

b. Discuss risk versus benefit factors in product design. **(P)**
Recycling: It's an Energy Issue
Energy from the Sun

5. Technological designs have constraints.

a. Describe examples of constraints on technological designs. **(T)**
Recycling: It's an Energy Issue
Power in South Carolina

b. Explain why constraints on technological design are unavoidable. **(T, N)**
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

6. Technological solutions have intended benefits and unintended consequences.
Recycling: It's an Energy Issue
Power in South Carolina
Energy from the Sun

III. Earth Science

Unit of Study: Ecology - The Abiotic Environment

A. Structure of the Earth System

4. The atmosphere is a mixture of nitrogen, oxygen and trace gases that include water vapor.

a. Infer how air pollution effects people and the environment.
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c. Analyze ways air pollution can be reduced.
Energy from the Sun

5. **The sun is a major source of energy for changes on the Earth's surface. Energy is transferred in many ways. (Transfer of Energy: Physical Science)**
   a. Analyze the greenhouse effect and its consequences. **(P)**
   Recycling: It's an Energy Issue

   b. Describe ways that humans may be influencing or contributing to global warming. **(P)**
   Recycling: It's an Energy Issue

6. **For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs. (Populations and Ecosystems: Life Science)**
   a. Describe how sunlight, through photosynthesis, is transferred by producers into chemical energy.
   Energy from the Sun

   c. Examine how energy is transferred through an ecosystem.
   Energy from the Sun

7. **The number of organisms an ecosystem can support depends upon the abiotic factors. Given adequate abiotic resources and no disease or predators, populations (including humans) increase at a rapid rate. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem. (Populations and Ecosystems: Life Science)**
   c. Distinguish between renewable and nonrenewable resources and examine the importance of their conservation. **(P)**
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   b. Evaluate the effects of human population on air, water and land. **(P)**
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   g. Analyze the benefits of solid waste management (reduce, reuse, recycle). **(T, P)**
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IV. Physical Science

Unit of Study: Chemical Nature of Matter

A. Properties and Changes of Properties in Matter

1. Chemical elements do not break down during normal laboratory reactions involving such treatments as heating, exposure to electric current or reaction with acids. Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties.

a. Distinguish between physical and chemical properties.
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b. Distinguish between physical and chemical changes.
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Grade Eight

I. Inquiry

A. Abilities Necessary to do Scientific Inquiry

1. Identify process skills that can be used in scientific investigations.

a. Observe

2. Distinguish between qualitative and quantitative observations.
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c. Measure

1. Select and use appropriate tools (e.g., metric ruler, graduated cylinder, thermometer, balances, spring scales and stopwatches) and units (e.g., meter, liter, Celsius, gram, Newton and second) to measure to the unit required in a particular situation.
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2. Select and use appropriate metric prefixes to include milli-, centi- and kilo.
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d. Infer

1. Make inferences based on observations.
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2. Design and conduct a scientific investigation.

b. Pose questions and problems to be investigated.
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c. Obtain scientific information from a variety of sources (such as Internet, electronic encyclopedias, journals, community resources, etc.).
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f. Collect and record data using appropriate metric measurements.
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g. Organize data in tables and graphs.
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h. Analyze data to construct explanations and draw conclusions.
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3. Use appropriate tools and techniques to gather, analyze and interpret data.

a. Select and use appropriate tools and technology (such as calculators, computers, probes, thermometers, balances, spring scales, microscopes, binoculars and hand lenses) to perform tests, collect data and display data.
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4. Develop descriptions, explanations, predictions and models using evidence.

a. Discriminate among observations, inferences and predictions.
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b. Construct and/or use models to carry out/support scientific investigations.
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5. Think critically and logically to make relationships between evidence and explanations.

a. Review and summarize data to show cause-effect relationships in experiments.
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6. Recognize and analyze alternative explanations and predictions.
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7. Communicate scientific procedures and explanations.

a. Use drawings, written and oral expression to communicate information.
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b. Create drawings, diagrams, charts, tables and graphs to communicate data.
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c. Interpret and describe patterns of data on drawings, diagrams, charts, tables, graphs and maps.
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d. Create and/or use scientific models to communicate information.
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8. Use mathematics in all aspects of scientific inquiry.

a. Use mathematics to gather, organize and present data.
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b. Use mathematics to structure convincing explanations.
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B. Understandings about Scientific Inquiry

1. Different kinds of questions suggest different kinds of scientific investigations.

a. Relate how the kind of question being asked directs the type of investigation conducted (e.g., observing and describing, collecting, experimenting, surveying, inventing and making models).
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2. Current scientific knowledge and understanding guide scientific investigations.
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3. Mathematics is important in all aspects of scientific inquiry.
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4. Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results.

a. Compare and contrast the quality of data collected with and without technological devices.
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5. Scientific explanations emphasize evidence, have logically consistent arguments and use scientific principles, models and theories.

a. Discuss how scientific knowledge advances when new scientific explanations displace previously accepted knowledge.
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6. Science advances through legitimate skepticism.
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7. Scientific investigations sometimes result in new ideas and phenomena for study.
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C. Abilities of Technological Design

1. Identify appropriate problems for technological design.

a. Identify a specific need for a product.
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b. Determine whether the product will meet the needs and be used.
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2. Design a solution or product.

a. Compare and contrast different proposals using selected criteria (e.g., cost, time, trade-off and materials needed).
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b. Communicate ideas with drawings and simple models.
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3. Implement a proposed design.

a. Select suitable tools and techniques to ensure adequate accuracy.
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b. Organize materials, devise a plan and work collaboratively where appropriate.
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4. Evaluate completed technological designs or products.

a. Measure the quality of the product based on the original purpose or need and the degree to which it meets the needs of the users.
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b. Suggest improvements and try proposed modifications to the design.
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5. Communicate the process of technological design.

a. Identify the stages of problem design: (1) problem identification, (2) solution design, (3) implementation and (4) evaluation.
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D. Understandings about Science and Technology

1. Scientific inquiry and technological design have similarities and differences.

a. Compare and contrast scientific inquiry and technological design.
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2. Many different people in different cultures have made and continue to make contributions to science and technology.

a. Describe examples of contributions people have made to science and technology. **(H, N)**
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3. **Science and technology are reciprocal.**
   a. Explain how science and technology are essential to each other. **(T)**
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4. **Perfectly designed solutions do not exist.**
   a. Discuss factors that affect product design and alter the original design. **(T)**
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   b. Discuss risk versus benefit factors in product design. **(P)**
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5. **Technological designs have constraints.**
   a. Describe examples of constraints on technological designs. **(T)**
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   b. Explain why constraints on technological design are unavoidable. **(T, N)**
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6. **Technological solutions have intended benefits and unintended consequences.**
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IV. Physical Science

Unit of Study: Light

B. Transfer of Light Energy

2. **Light interacts with matter by transmission (including refraction), absorption or scattering (including reflection). To see an object light from that object - emitted by or scattered from it - must enter the eye.**
   a. Distinguish between objects producing light and objects reflecting light.
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   b. Investigate and describe the properties of reflection, refraction, transmission and absorption of light.
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   c. Classify objects as opaque, transparent or translucent.
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Grades Nine-Twelve

I. **Inquiry**

Inquiry is not an isolated unit of instruction and should be embedded throughout the content areas. The nature of science and technology are incorporated within this area.

A. Identify Questions and Concepts that Guide Scientific Investigations

Experimental design should demonstrate logical connections between a knowledge base and conceptual understanding.

1. Formulate a testable hypothesis based on literary research and previous knowledge.

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2. Identify and select experimental variables (independent and dependent) and controlled conditions.

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B. Design and Conduct Investigations

Prior knowledge about major concepts, laboratory apparatus, laboratory techniques and safety should be used in designing and conducting a scientific investigation.

1. Design a scientific investigation based on the major concepts in the area being studied.

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2. Select and use appropriate instruments to make the observations necessary for the investigation, taking into consideration the limitations of the equipment.

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3. Identify technologies that could enhance the collection of data.

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7. Conduct a laboratory investigation with repeated trials and systematic manipulation of variables.

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8. Identify possible sources of error inherent in an experimental design.

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9. Organize and display data in useable and efficient formats, such as tables, graphs, maps and cross sections.

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10. Draw conclusions based on qualitative and quantitative data.

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11. Discuss the impact of sources of error on experimental results.

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12. Communicate and defend the scientific thinking that resulted in conclusions.
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C. Use Technology and Mathematics to Improve Investigations and Communications

Scientific investigations can be improved through the use of technology and mathematics. While it is acknowledged that the SI system is the accepted measurement system in science, opportunities to use the English System are encouraged.

1. Select and use appropriate technologies (e.g., computers, calculators, CBL's) to enhance the precision and accuracy of data collection, analysis and display.
   Sun Bathing

2. Discriminate between data that may be valid or anomalous.
   Sun Bathing

D. Formulate and Revise Scientific Explanations and Models Using Logic and Evidence

Scientific explanations and models are developed and revised through discussion and debate.

1. Construct experimental explanations or models through discussion, debate, logic and experimental evidence.
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   Fuel Wise or Fuelish?

2. Develop explanations and models that eliminate bias and demonstrate the use of ethical principles. **(P)**
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3. Revise explanations or models after review.
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E. Recognize and Analyze Alternative Explanations and Models

Scientific criteria are used to discriminate among plausible explanations.

1. Compare current scientific models with experimental results.
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2. Select and defend, based on scientific criteria, the most plausible explanation or model.
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F. Communicate and Defend a Scientific Argument

Experimental processes, data, and conclusions should be communicated in a clear and logical manner.

1. Develop a set of laboratory instructions that someone else can follow.
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2. Develop a presentation to communicate the process and conclusion of a scientific investigation.
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G. Understandings about Scientific and Technological Inquiry

Historical scientific knowledge, current research, technology, mathematics and logic should be the basis for conducting investigations and drawing conclusions.

1. Analyze how science and technology explain and predict relationships.
   a. Defend the idea that conceptual principles and knowledge guide scientific and technological inquiry.
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   b. Explain how historical and current scientific knowledge influences the design, interpretation and evaluations of investigations.
      1. Discuss the reasons scientists and engineers conduct investigations.
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      2. Defend the use of technology as a method for enhancing data collection, data manipulation and advancing the fields of science and technology.
         Sun Bathing

      3. Explain how mathematics is important to scientific and technological inquiry.
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      4. Explain why scientific models and explanations need to be based on historical and current scientific knowledge.
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      5. Understand that scientific explanations must be logical, supported by the evidence and open to revision.
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II. Life Science

D. Interdependence of Organisms

5. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology and consumption. Human destruction of habitats through direct harvesting,

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pollution, atmospheric changes and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

a. Identify events that led to awareness of environmental concerns such as fish kills, destruction of the ozone layer, global warming and decline of the bald eagle. **(H)**

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Radioactive Waste Disposal

b. Discuss the conflicts that could occur between land developers and conservationists. **(P)**

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e. Give examples of how technology has advanced the study of environmental science. **(T, P)**

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F. Behavior and Regulation

2. Organisms have behavioral responses to internal change and external stimuli. Responses to external stimuli can result from interactions with the organism's own species and other, as well as environmental changes; these responses can be either innate or learned. The broad patterns of behavior exhibited by animals have evolved to ensure reproductive success. Animals often live in unpredictable environments and so their behavior must be flexible enough to deal with uncertainty and change. Plants also respond to stimuli.

d. Assess both the positive and negative effects of introducing chemical substances into the body. **(P)**

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III. Earth Science

B. Geochemical Cycles

1. The Earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs. Each element on Earth moves among reservoirs in the solid earth, oceans, atmosphere and organisms as part of geochemical cycles.

c. Evaluate the importance of limiting consumption of nonrenewable resources. **(T, P)**

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IV. Physical Science (CHEMISTRY)

A. Structure of Atoms

1. Matter is made of minute particles called atoms, and atoms are composed of even smaller components. These components have measurable

properties, such as mass and electrical charge. Each atom has a positively charged nucleus surrounded by negatively charged electrons. The electric force between the nucleus and electrons holds the atom together.

c. Compare and contrast the component particles of the atom.
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2. The atom's nucleus is composed of protons and neutrons, which are much more massive than electrons. When an element has atoms that differ in the number of neutrons, these atoms are called different isotopes of the element.

b. Identify the charge, component particles and relative mass of the nucleus.
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3. The nuclear forces that hold the nucleus of an atom together, at nuclear distances, are usually stronger than the electric forces that would make it fly apart. Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure, and is the process responsible for the energy of the sun and other stars.

a. Contrast the energy released by nuclear reactions to that released by chemical reactions.
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b. Compare and contrast fission and fusion reactions showing how they are processes that convert matter to energy.
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e. Debate the consequences of the development of nuclear applications such as the atomic bomb, nuclear power plants and medical technologies. **(P)**
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Radioactive Waste Disposal

C. Chemical Reactions

1. Chemical reactions occur all around us, for example in health care, cooking, cosmetics and automobiles. Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our bodies.

c. Explain the sources and environmental effects of some inorganic and organic toxic substances, such as heavy metals and PCB's. **(P)**
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IV. Physical Science (PHYSICS)

A. Motions and Forces

4. Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. These effects help students to understand electric motors and generators.

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c. Compare and contrast electrical motors and electrical generators in terms of energy transfers. **(N, T)**
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d. Examine the effects of the advent of electricity on individuals and society. **(H, N, P, T)**
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B. Conservation of Energy and the Increase in Disorder

1. The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

a. Evaluate transformations between potential and kinetic energies and other forms of energy.
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c. Cite or identify examples of how the disorder of matter changes with energy changes. **(N)**
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2. All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

a. Classify energy types as potential, kinetic or electromagnetic.
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3. Heat consists of random motion and the vibrations of atoms, molecules and ions. The higher the temperature, the greater the atomic or molecular motion.

b. Assess particle motion and distance as they relate to temperature and phase changes.
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4. Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation or convection and the warming of our surroundings when we burn fuels.

b. Compare and contrast the environmental impact of power plants that use fossil fuels, water and nuclear energy to produce electricity. (P, T)
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